What is this Fuego thing and Where is it going?

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Outline

Vision
Major elements
Architecture
Details
Roadmap

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Vision – super high level

Do for testing
what open source
has done for coding

- Fuego Goal:
  - *Promote the sharing of tests, test methods, and results, the way code is shared now*
    - Make it easy to create, share and discover tests
    - Make test results easy to share and evaluate

Fuego is a test framework focused on tests and test re-use

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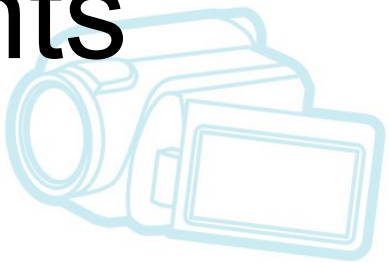


Major Elements

- Jenkins interface
- Test execution system
- Pre-packaged tests
- Docker container
- Test distribution

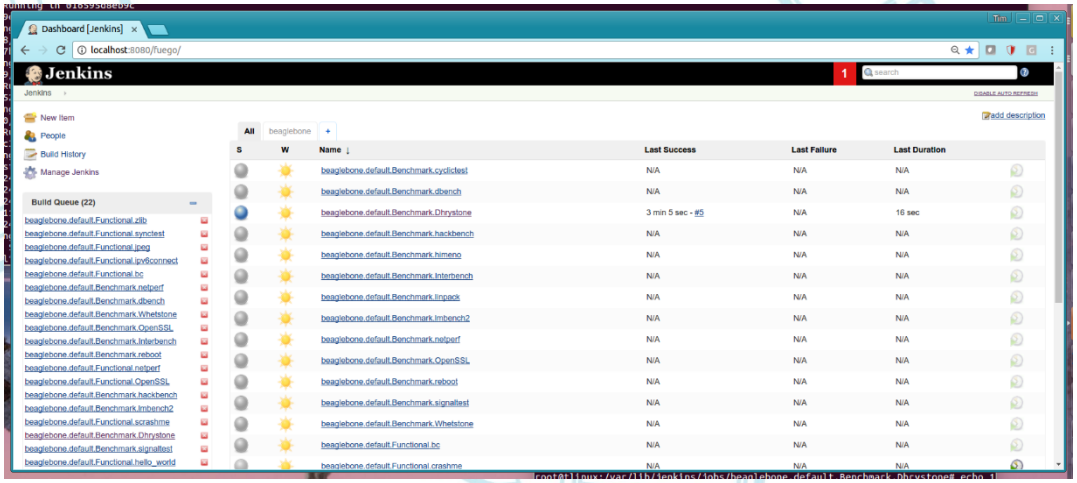
Jenkins

- Is a Continuous Integration system
- Handles job scheduling, notifications, visualization, etc.
  - Launches test jobs based on various triggers
  - Shows test results
  - Has an very large ecosystem of plugins for lots of extended functionality
    - E-mail notifications
    - Plotting of results
    - Integration with different source code management systems
- Is too big a system to describe in detail here

Jenkins

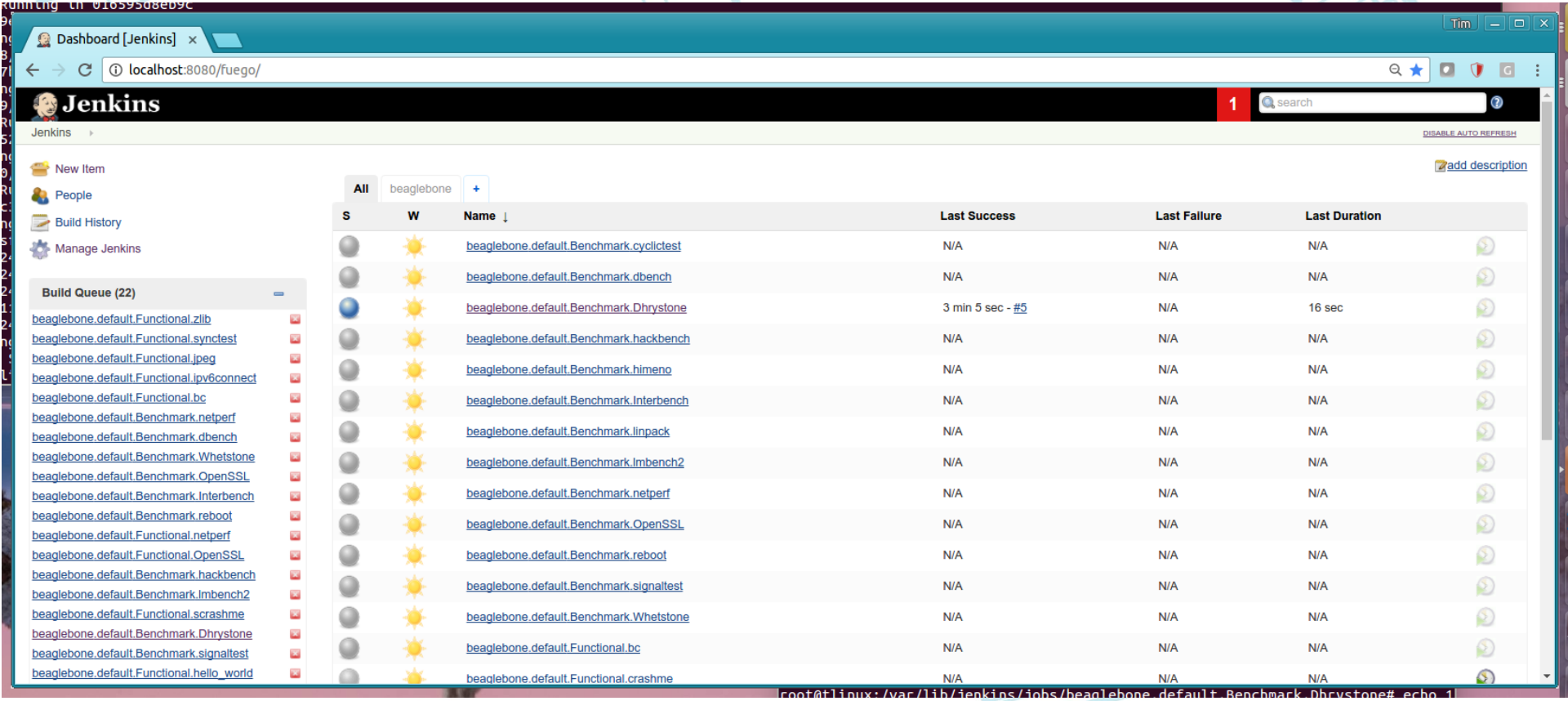
- Base interface:

  Build queue and job list



- Fuego provides instances of Jenkins objects
  - Jenkins node = Fuego board (Device under test)
  - Jenkins job = Fuego test
- Fuego has a custom plugin for plotting

A closer look



Test execution system

- Runs the test
  - Constructs the test environment
  - Executes the test in multiple phases
    - Build, deploy, run, process results
  - Evaluates results
- Fuego system allows customization
  - Test parameters
  - Results evaluation criteria
  - Board and platform management functions
- Test results are converted into a unified format

Pre-packaged tests

- Comes with over 100 tests, already integrated
  - aim7, aiostress, arch_timer, blobsalad, bonnie, bzip2, cmt, crashme, cyclictest, dbench, dhrystone, ebizzy, , expat, ffsb, fio, fontconfig, glib, GLMark, gtkperf, hackbench, himeno, Interbench, IOzone, iperf, ipv6connect, Java, jpeg, kernel_build, kselftest, libpng, linpack, linus_stress, lmbench2, LTP, nbench, netperf, netpipe, OpenSSL, posixtestsuite, reboot, rmaptest, signaltest, Stream, scifab, scrashme, sdhi_o, stress, synctest, tiobench, whetstone, x11perf, zlib, and many others
  - Goal is to have thousands of tests for user to choose from
- Test categories:
  - File system, networking, real-time, graphics, cpu performance, Posix conformance, etc.
- Includes functional and benchmark tests

Inside a container

- Fuego builds a docker container during installation
  - Container has auxiliary programs and libraries needed for test system
- This avoids install issues
  - Fuego can run on any Linux distro
- Used as a controlled execution environment
  - Builds of the test programs are reproducible
- Provides an isolated environment for security
  - Portions of tests execute on the host machine
  - Container prevents a test from disrupting the host

Fuego is a Linux distribution

- Distribution inside the container has all the tools that a host needs to conduct tests
  - Toolchains
  - Servers
  - Libraries
  - Emulators
  - Parsers
  - Test software itself
- Goal is to curate testing resources for the user (QA engineer)

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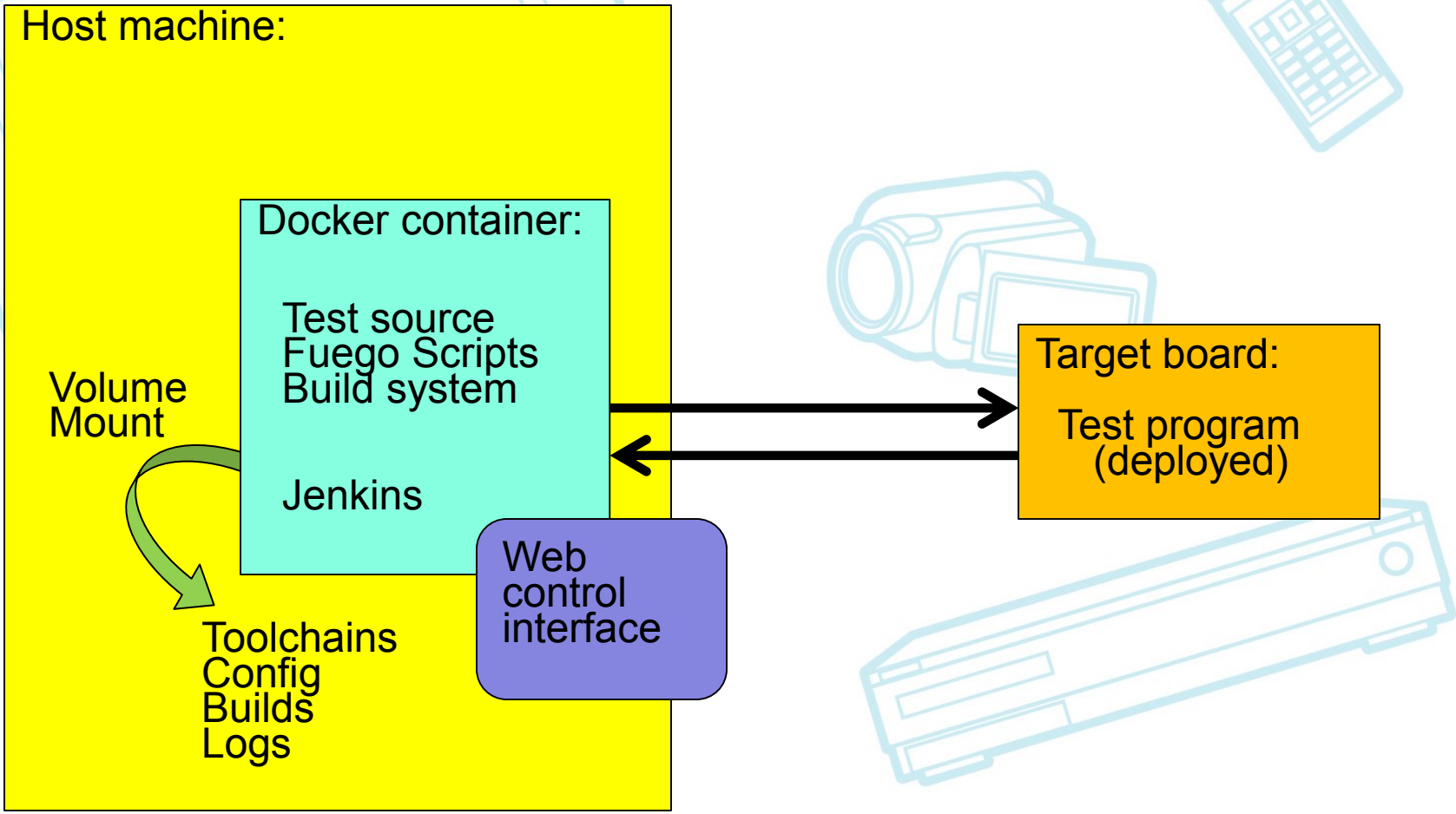
Architecture Diagram



Architecture

- Is intrinsically host/target
  - Software is cross-compiled
  - Test execution is directed by a host machine
  - Minimal requirements for the Device Under Test
    - e.g. Posix shell, a few common utilities (e.g. cat, grep)
    - No assumptions about interpreters, libraries, etc:
      - Only run shell script or natively compiled code
- Fuego can wrap existing test programs
  - E.g. Dhyrstone, hackbench, LTP
- Or execute new custom programs

Division of roles

- Layering of functionality:
  - Docker provides overall build and execution environment
  - Jenkins handles job scheduling and results presentation
  - Fuego scripts build the test program, deploy it to the target, and post-process results
  - Test program executes on the target board
- User can do operations at command line

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Fuego details

- Test building
- Fuego source
- Installation
- Fuego abstractions and customization
- Using Fuego (outline)
- Test elements

Test building

- Tests are built from source
  - You provide your toolchain (SDK)
    - Can use a pre-installed generic toolchain in some cases
- Fuego supports any target architecture
- If test program is a simple shell program, a build is not needed
- Resulting program is transferred to target during test
  - No need to have it pre-installed
    - But it can be

Fuego source

- Comes as 2 git repositories:
  - 'fuego' repository - Stuff outside the container
    - Container build system
      - Including some Jenkins plugins
    - Default config and boards
    - Host scripts for controlling the container
    - Documentation
  - 'fuego-core' repository - Stuff inside the container
    - Script and overlay engine
    - Pre-packaged tests
    - More jenkins extensions

Installation

- Simple installation
  - Requirements met by packages installed in container
- Steps:

```
$ git clone https://bitbucket.org/fuegotest/fuego.git
$ git clone https://bitbucket.org/fuegotest/fuego-core.git
$ cd fuego ; ./install.sh
        (wait a bit while docker image and container are created)
$ ./start.sh
$ ftc add-node –b localhost
        (then, populate the interface with the jobs you want to run)
$ ftc add-jobs –b localhost –p testplan_default
      $ chrome http://localhost:8080/fuego
```

Fuego Abstractions

- Fuego tests and boards are simple shell scripts:
  - Board: Variables describing board properties
  - Tests: Functions to build, deploy, execute test
- Fuego provides functions for command and control of target:
  - Put/get files, execute commands, collect logs, etc.
- Fuego customizes test variables at runtime
  - Based on board information, toolchain configuration, and test variant definitions
  - This allows any aspect of a test to be abstracted

Test parameter abstraction

- Test variables (or parameters) allows a test to be run in different variations.
- Fuego abstracts target access methods
  - get, put files, command execution
- Fuego also abstracts:
  - Toolchain for software builds
  - Filesystem block device names and mount points
- User can add new items to be abstracted
- Test plan system allows a single test to be run in multiple variations
  - A test variant is called a ‘spec’

Using Fuego (outline)

- To use existing tests:
  - Add a board configuration
  - Add a toolchain
  - Select tests to run
    - Add jobs for tests to the Jenkins interface
  - Configure job triggers
- To customize existing tests:
  - Adjust test parameters
  - Customize results processing

Test elements

- fuego_test.sh
  - Simple shell file with functions called by fuego:
    - test_build
    - test_deploy
    - test_run
  - Also indicates test program source
    - Usually a tarball, but can be a git repo reference
- May include a python program for parsing results from the test log file
  - Results are converted to structured data
- May include a file to describe pass criteria
- May include a file with test metadata

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Where is it going?

Staying in my lane...

- I don't want to add to Fuego:
  - Email-based patch CI triggers
  - SUT image provisioning
  - Board control drivers/lab management software
  - Centralized results repositories
  - Distributed results visualization
- I want to focus where Fuego is different:
  - Repository of test definitions
  - Generalized output parsing system
  - Sharing of pass criteria and testcase documentation

Roadmap

Where is it going?

- Test definition improvements
- Modularization
- More tests
- Central server for sharing tests
- Interoperability with other systems

Next – test definitions

- Batch jobs for complex pipelines
  - Replacing current testplan system
- Migrate toward standard test definition format
  - *Requires defining a standard test definition*
- Support for provisioning

Next – more stuff

- Modularization
  - Separation of Fuego core from Jenkins
    - To use with other job schedulers, like LAVA
    - To use with other results visualizers, like Squad
  - Create a standalone parser
- More tests
  - Particularly for LTS kernels
    - (Dependent on provisioning work)
- Central server for sharing tests
  - The “test store”
  - The “test dispatcher”

Test server concept

- Goal is to increase testing by creating a (large) distributed test network
- Most systems are based on LAB testing
  - Labs have specialized hardware for automation
- Fuego is focused on “board at desk” model
  - Model should scale better due to lack of HW requirement
    - Should scale to # of contributors to Linux
    - ie. Anyone should be able to run a test
- There will always be more nodes NOT connected to automation hardware than connected

Test server concept (cont.)

- Requires appropriate disposition of results
  - To support “mining” of results requires standardized results format
    - Including standardized testcase name space
  - or realtime feedback to test requestor
- Create a virtual distributed lab
  - Developer can request a test on hardware not normally available to them
  - Long-term goal is 10,000 nodes
  - Automatic routing of test requests to appropriate nodes

Next - interoperability

- Interoperability with other systems
  - Lab APIs
    - PDU standard
  - External hardware API
    - Probably start with power measurement monitor API
  - Re-using tests from other systems
  - Exporting tests to other systems

Legacy Roadmap items

- Documentation
  - Conversion to reStructuredText
    - Convert documentation from wiki to ReadTheDocs
  - Tutorials

We're going to keep working on it!!

Resources

- Fuego web server:
  - http://fuegotest.org/
  - wiki: http://fuegotest.org/wiki
- Mailing list:
  - https://lists.linuxfoundation.org/mailman/listinfo/fuego
- Repositories:
  - https://bitbucket.org/fuegotest/fuego
  - https://bitbucket.org/fuegotest/fuego-core


Fuego

Bonus Material

Why is it called “Fuego”?

- Fuego = Tierra del Fuego
  - One place where penguins live
- Fuego = Fire
  - Often associated with trials and purifying
- It sounds neat

Old roadmap (Dec 2017)

- Listed here to show changes in emphasis
- To give us a Roadmap scorecard

Old Roadmap (cont.)

- Near future (cont.):
  - Testplan enhancements
    - Controlled test sequences
      - Similar to Jenkins pipelines
      - Processing multiple steps (provisioning, testing, notifications, report generation) in sequence
    - More fields for plan configuration
    - *[This turned into the new batch job system, and is still in development]*
  - Report generator and more charting control
    - Now that we have unified output, we can do queries, and different output formats
    - *[Not much progress here]*

Old Roadmap (cont. 2)

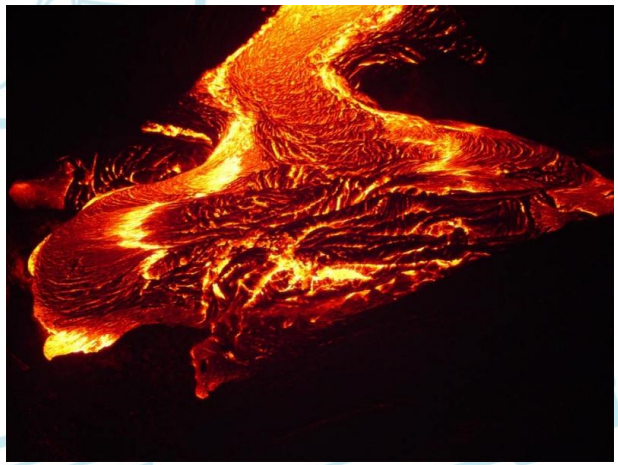
- Near future:
  - Documentation
    - Conversion to reStructuredText
    - Refactoring
    - Tutorials
  - New tests for AGL, LTSI, CIP
    - What tests to tackle next?

Old Roadmap (cont. 3)

- Near future (cont.):
  - System provisioning support
    - Install of software under test
      - Has been out-of-scope for Fuego
    - e.g. AGL image deploy, LTSI kernel update, etc.
    - Full automation requires board management API
    - Looking at labgrid as possible solution
  - *[No progress – blocked on new batch system]*
- Long-term
  - Distributed test network – [*some progress on fserver]*
  - Hardware testing – *[no progress]*

Other Priorities

- LAVA integration
  - We have everything needed for transport integration
  - Need test-level integration
    - Separate build phase
      - *[done]*
    - Deploy to LAVA server
      - *[prototyped?]*
    - Create LAVA test that does:
      - Execute test on board
      - Collect results
    - Execute Linaro test
      - *[prototyped?]*
  - *[some progress made]*



Previous roadmap scorecard

- Testplan enhancements — Almost done with phase 1
- Report generator — No progress
- Documentation improvements — No progress
- Distributed test network — Fserver code integrated
- Hardware testing — No progress- blocked on HW API
- LAVA Integration — Some prototypes written
- Release self-test — Stopped working – no maintenance

Obstacles to roadmap

- Fuego doesn't do provisioning
  - Automated installation

Dev board installation issues

- Many dev boards use SDcard design
- not set up for automated re-installation
- may not support top-of-tree (version gap)

Distributions don't support automated replacement of kernels

- Can't automate putting a top-of-tree kernel into an existing distribution
  - Due to:
    - Version gap
    - Distribution-specific patches
  - If you could automate this, you could automate distribution maintenance
- Current solution:
  - Put a new kernel on the board, and hope that nothing breaks
    - Hope that the parts that are incompatible are not under test
- Version gap is inevitable – that's a problem

Automated installation

- Dev board is not the final product
- Final product may not support software update
- Final product is locked down
  - Users not allowed to manipulate software
    - Can't install different kernel or test programs
- Final product may support OTA update
  - Requires setting up a service for OTA delivery
  - Limited permissions to install software
  - Requires special keys to install replacement software
- Automated re-installation of software is contrary to software security on the device
  - this is by design